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BETTER FRUIT

VOLUME XIII

JANUARY, 1919

NUMBER 7



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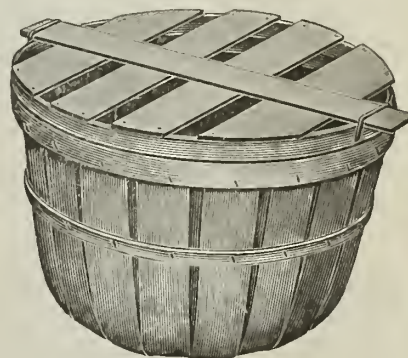
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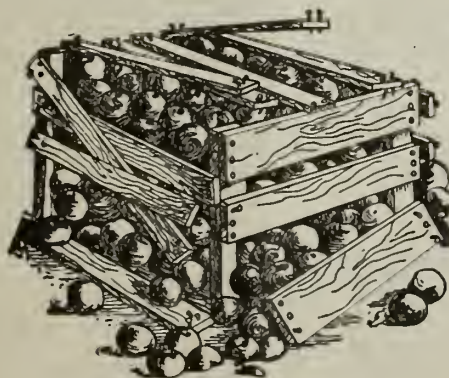
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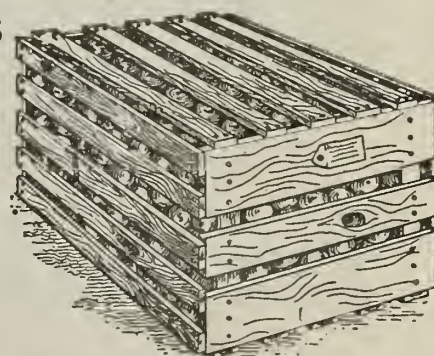
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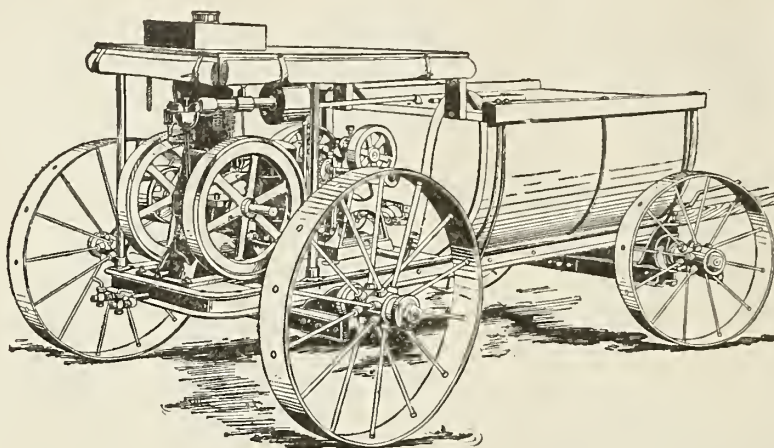
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Premature Deterioration in Fruit

Address by C. I. Lewis, Chief, Division of Horticulture, O. A. C., before Oregon State Horticultural Society, Roseburg, December 5, 6 and 7, 1918

DURING the past two falls there has been a pretty general complaint from the fruit growers of Oregon that much of their fruit was deteriorating prematurely. The deteriorations in question are varied in their character, and can be attributed to two chief causes; first, climatic, and, second, to cultural or orchard methods. We must remember that the Pacific Northwest has had two of the driest seasons in its history and that the past seasons have not only been unusually dry but very hot. Strange as it may seem, September, our early harvesting month, was the hottest month of the entire year. In fact, it was so hot for several days during September that much of the fruit was severely burned on the tree. Under such conditions we may naturally expect certain deteriorations or troubles to arise.

To make matters worse, we have coupled unfavorable climatic conditions with careless tillage, irrigation, spraying, etc., encouraging such trouble to become aggravated and more severe. Again, severe drouth has caused an early maturity of the fruit. In fact, many apples which ordinarily do not mature until the middle or latter part of September should have been picked this last season the latter part of August or the first of September. Yet many growers failed to sense the difference in the condition of their fruit and allowed the fruit to hang on the trees far too late. If there is one general criticism that I would make of the apple growers of the Pacific Northwest as regards the time and methods of harvesting their apples, I would say that it was that we pick our apples too late, especially our summer, fall and early-winter varieties. We are so anxious to secure the maximum of color that we allow the fruit to deteriorate before we take it from the trees. During unusually hot and dry seasons as we have just past the color does not develop as much as normally, and when color does come on it seems to come very late. A few rains in the fall, a sharp frost and general changes in the weather encourage the formation of color on the fruit more than hot dry weather. There is no question at all but what a large percentage of such

varieties as Gravensteins, Grimes, Winter Bananas, Jonathans and Spitzenbergs were allowed to hang on the trees far too long this past fall, and in a few cases where the trees have suffered from drouth even some of our varieties like the Yellow Newtowns were allowed to remain beyond the proper date for picking. Owing to the lateness in picking some varieties of apples seem to have a tendency to develop a sort of core rot or decay just around the core. This trouble is seemingly more pronounced in such varieties as the Jonathan, Delicious, Gravenstein and Ortley. Some varieties have a tendency to develop a premature melowness, or dryness, become devoid of juice and unpalatable. This condition is almost invariably due to over-maturity on the trees and commonly attacks such varieties as Spitzenbergs, Jonathans, Baldwins, Delicious and Wageners. In fact, nearly all of the fall and early-winter varieties are subject to this deterioration.

Cracking of the fruit was quite pronounced this past year, and as far as apples are concerned this cracking seems to be due very largely to early maturity. In tillage experiments and irrigation experiments we have conducted we have found the check plots were the ones that suffered the most from cracking either the calyx or about the stem. This was due partly to the fact that the dry checks matured their fruit earlier and it should have been picked sooner than we generally practice. You are all aware how Red Astrachan apples will crack when they are over-developed on the trees. This cracking seems to have attacked nearly all varieties, especially where they are suffering for want of moisture, and the later the fruit hangs on the tree the more serious becomes the cracking. Cracking will sometimes occur on fruit after it is packed and stored. This is apt to be associated with fruit that has been kept too long. Such specimens generally have a mealiness or dryness of flesh. Also over-green specimens are subject to this trouble.

The cracking of some of our soft fruits like cherries, prunes, etc., seems to be due to an entirely different cause and it is generally found to be worse

right immediately after a heavy rain. During this past season, especially in the drier sections, there has been some trouble from drouth spots, cork and similar troubles which are closely associated and which all seem to have their origin in a lack of moisture or food for the tree. As the season advances these troubles seem to become more and more aggravated since the trees are suffering more and more for want of moisture. With many of our red apples as the Spitzenberg, Jonathan and Baldwin there is a noticeable spotting on the flesh and a slight depression takes place and very soon becomes dark. This condition is very commonly known as the Jonathan spot and it is certainly aggravated by allowing the fruit to stay on the trees too long, and secondly by keeping the fruit in poorly-ventilated places after it is harvested. Over-maturity plus poor storage will cause the appearance of much of this trouble.

There has been a great deal of so-called fruit pit, dry rot, etc., during the past year. Investigators in Australia, the United States and Europe have been working many years on this problem. None so far have carried their investigations to a point where they can definitely explain the appearance of this trouble under all conditions. All are satisfied that it is functional and due to some disturbance in the nutrition and moisture supply of the tree. In our work in the Hood River Valley since 1912, we have been able to eliminate to a very large extent much of these troubles. This has been brought about by giving the soil more nitrogen, encouraging the growing of alfalfa and clover, and encouraging a little more careful study of irrigation and avoiding excessive irrigation on the one hand or lack of irrigation on the other. Not only has such a condition eliminated a large amount of fruit pit but has likewise eliminated a great deal of so-called rosette, little leaf, or die-back. Abnormal trees seem to be affected more than those in normal condition. That is, a tree that is growing too vigorously and producing overgrown fruit generally has a good deal of fruit pit. Likewise a tree which has fruit that is very small and poorly developed often



Courtesy of Loma Rica Nurseries, Grass Valley, California

An illustration showing one of the great trees in the grove of wild *pyrus usuriensis* near the village of Shing-lung-shan, Chih-li Province, China. This was photographed by Frank N. Meyer, who was sent by the Bureau of Plant Industry to locate groves of *pyrus usuriensis* to gather seed for the growing of seedlings to be used as stocks upon which to propagate the commercial varieties of pears. Standing near the tree is Mr. Chow, Meyer's Chinese interpreter. The tree was more than two feet in diameter, nearly one hundred feet in height and probably between two hundred and three hundred years old.

has the fruit badly pitted. Again, some varieties are attacked worse than others. The Baldwin is a regular customer. In fact, so much so that it is doubtful if the Baldwin should be grown in any part of the Northwest. The Grimes is very seriously attacked by this trouble, but with the Grimes, Ortley and Winter Banana, the specimens which seem to be attacked the worst are the overgrown specimens. In non-irrigated districts it would not be feasible to follow the plan we have used in the Hood River Valley, but all that we can advise under such cases is to avoid any practice which tends to promote an abnormal condition in the trees. Try to follow good practices in tillage, pruning, etc., not allowing the trees to suffer on the one hand or to

over-stimulate them on the other, and we believe that under such conditions there would be a reduction of the fruit pit. In irrigated districts where the trees are bearing very heavily the growing of some crop among the trees and a careful study of irrigation will go a long ways toward the control of pit.

There has been an enormous amount of water coring in the West during the past year. This trouble became so severe in some districts that some of the growers became greatly alarmed and discouraged. Water coring is found every year, especially in some varieties. For example, the King of Tompkins County is very subject to its attacks and likewise the Wagener, Gravenstein and Winter Banana are

pretty regularly attacked by this trouble. The late summer and early fall varieties suffer the most, and this last year we found the trouble extending into the early winter and even the late winter varieties. In water coring, the cells fill with water and large watery sections appear in the fruit. Where the water coring is not very bad and is confined to relatively small areas it is somewhat hard to detect unless one cuts the fruit with a knife. Where the water coring becomes bad it begins to show on the outside of the fruit. First, the skin of the apple becomes a little rough and the surface slightly sunken, the fruit losing its smooth contour. Later the trouble advances to the stage where the water coring itself shows on the outside of the fruit.

Like the fruit pit, the largest specimens are apt to be the first attacked. The studies we have been able to make during the past years with this trouble indicate that over-maturity is responsible for much of the water coring in a great deal of our fruit. Where varieties are picked at the proper time the water coring can be kept down to the minimum, but where varieties like the Wagener, for example, are allowed to hang on the trees a week or so too long then one can expect a great deal of water coring to develop. Where any signs of water coring begins to develop the fruit should be picked off immediately. If the water coring has not been very bad much of it will disappear in storage. Excessive irrigation or a very heavy rain about the time the fruit is maturing seems to also encourage it. This has been often noted in the Pacific Northwest. Growers should watch the King, the Winter Banana and Wagener very carefully, indeed, for the first indications of water core, as this is one of the best signs that harvesting should be well under way.

A great many rots have developed in the apples the past year. Most of these can be attributed to one or two causes. The anthracnose spots on the one hand and the wormy apples on the other. Both of these troubles can be cured by spraying. Unfortunately, however, this past year the weather was so warm the codling moth seemed to come out over a very long period, the second brood appearing from early August until well into September, so that it was only with great difficulty and care that one could keep down the percentage of wormy apples. Many growers were far too careless along this line, and should they have gone into their orchards and done some spraying they could have saved much money. Likewise, the leaf roller was very bad on apples and even on some varieties of pears, but this is not a serious problem, as it can be controlled by efficient spraying. There are sections of Oregon that will have to take the leaf roller into account this coming season.

Pear growers of the Pacific Northwest have been experiencing some trouble with their fruit. We have recently been conducting certain investi-

gations on this subject. The first year's work has recently been published in the Experiment Station Bulletin No. 154, entitled "A Preliminary Report on Pear Harvesting and Storage Investigations." The growers can secure copies of this bulletin by dropping a line to the Experiment Station. Before the harvesting time of another season arrives we will have a second report on this subject which will contain some very interesting data concerning a physical test for the picking of pears. Since this bulletin will be available to all growers, and likewise Bulletin 154, I will not take the present time to elaborate on this problem, but refer you to this bulletin.

The prune growers have been having their troubles in the past year. Many of the orchards, especially older orchards, suffered greatly from the drouth. Some orchards planted on thin soil, trees that were attacked by borers and orchards that were generally neglected, all showed the effects of the hot dry season. This was shown by an early deterioration of the fruit. It often became discolored, turning reddish, and large dark green areas, which had a watery appearance and which often had little green drops on them, were very noticeable on the prunes early in the summer. Some of the fruit developed nicely so that it could be evaporated, but a good deal of it did not, and it dropped to the ground or was found unfit for use at the time of evaporating. In other cases, the fruit became greatly malformed and distorted. Large depressed areas were caused in the fruit, and upon cutting the fruit through with a knife these areas were underlaid with a discolored portion of the flesh, often being brown

in color. Large areas of the flesh often became dry, almost corky, and it was plain to see that the cells had broken down and that such fruit was a total loss. While there was a great fluctuation as regards the amount of this trouble it seemed to be fairly well correlated with thin soils, borers and devitalized trees. There was much less of the trouble on the better soils or on trees that were shown to be in very good vigor. A few more cover crops and the addition of a little manure or nitrates and more intensive irrigation and cultivation would probably do much to rid the prune of such troubles.

The walnut growers have been experiencing this year considerable trouble with the condition which we call perforation. I have been in the state thirteen years and this is the first time that we ever had very many samples sent in from Oregon. It is quite a common trouble with some of the walnut growers in California. In perforation the shells of the walnut are very thin, so that often the kernels are exposed. With perforation the meat and the skin on the kernel seem to develop normally and often the thin inner lining or inner shell covering the kernel, but the hard outer shell of the walnut seems to fail to develop. Thus we have a perforation. California writers who have had an opportunity to investigate this trouble tell us that there are probably two factors at work to help produce this condition, namely, fertilization or pollination of the nuts during the blooming period and its nutrition during the growing season. In California perforation seems to be unusually abundant during dry years such as we have had in the past two

years in the Northwest. They have also noticed that when the trees are badly attacked by the walnut aphid the trouble is aggravated. It does not attack all trees, sometimes only one or two trees in a row have this trouble, while all the others seem to produce normal nuts. In some cases where pollination has been interfered with by continued dry weather or frost during the blooming period, perforation has apparently been more common. This latter statement, however, probably needs more investigation to be thoroughly verified. In conclusion, it would seem that the disease is probably due to the extreme drouth, the soil becoming so dry that the trees do not get food and moisture enough, as the English walnut is a big feeder. Again, if a tree is attacked by aphid or other troubles which cut down the moisture supply even more we can expect the trouble to become more serious.

In conclusion, I feel that the growers of the Pacific Northwest need not feel discouraged because of the trouble they have had during the past two years. We must remember that the conditions were not normal and it is seldom that we have two years in succession like the past two. We have certainly learned that we must start our orchard cultivation and irrigation earlier and we must not allow the drouth to affect our trees as seriously as it has during the past year. Perhaps after all it will be more or less of a lesson encouraging us to a little better and more thorough orchard practice. Despite the various troubles enumerated our crop on the whole was good, prices excellent and the growers as a class excellent.

Some Prune Fruit Troubles of Non-Parasitic Nature

Address by H. P. Barss, Chief in Botany and Plant Pathology, Oregon Agricultural College Experiment Station, before Oregon State Horticultural Society, Roseburg, December 7, 1918

WE have just passed through a remarkable season, quite out of the ordinary in many respects. This is certainly true from the standpoint of the plant doctor who has been watching conditions affecting the health of the crops in the state. There has been far less damage than usual from many of the commonest and ordinarily most destructive diseases, but peculiar and unrecognized troubles have appeared and the help of the pathologist has been called for by scores and scores of farmers to diagnose and if possible prescribe a remedy for them. In the experience of the plant doctor climate is found to have a tremendous influence on the prevalence and severity of different diseases. He knows that a wet season will mean much financial loss to growers on account of the multitude of microscopic parasites, mostly fungi of one kind or another, which attack vigorously and thrive well under moist conditions. On the other hand, he is well aware that prolonged dry weather during the growing season favors very few of these commoner parasites and reduces materially the

loss from diseases they cause. But such dry weather brings on many troubles of a non-parasitic nature which are often difficult of diagnosis and even more difficult of control. The season just past has felt the consequences of early and prolonged absence of rain and troubles of a non-parasitic nature have been conspicuous, while those of parasitic origin like apple and pear scab, leaf spots, fire blight and brown rot have in general been far less severe than usual. The prune growers for the most part lost but little this year from that dreaded destroyer of fruit, the brown rot fungus, but in some sections they experienced losses from troubles of a non-parasitic sort and it is in order to throw a little more light, if possible, on the nature and peculiarities of such troubles that I am asked to talk to a few minutes today. The conditions which have affected the prune have also affected many other crops, and I shall not attempt to confine myself strictly to the prune during this discussion.

We want first to get at the cause underlying the commoner non-parasitic disturbances about which we are in-

terested, but first I wish to lead up to the subject by asking if any of you ever had to work in the harvest field on a roasting hot day after the water jug went dry? If so you know the distress, growing into anguish, which the worker feels when, without a drop to drink, he goes on laboring and sweating in the heat. It doesn't take a physician's examination to detect that something goes radically wrong in the human system under such circumstances. The thickened blood and sluggish circulation, the gradually decreased energy and dwindling ability to put forth effort, all indicate that the healthy functions of the body have been interfered with to a detrimental extent. Water is a very necessary thing for the human body, for its health and normal activities. Lack of water is very injurious to men, and under conditions inducing excessive perspiration when a large amount of water is given off from the skin, it takes but a very short time if the water supply is inadequate to bring about a great change from the normal and healthy physiological state of the human system. In this respect, what is

true of the human being is true of all living things, vegetable as well as animal. An abundant moisture supply is essential to health and a lack of it means internal disorder. The greatest number of genuinely non-parasitic diseases in plants are induced by disturbed water relations, and it is this group of troubles we want to consider particularly today.

There is a very close analogy between the prune orchard under the blazing sun on a hot day in the middle of a long summer and the laborer in the harvest field under similar conditions. The man perspires freely and so does the tree, only scientists call it transpiration in the case of plant life instead of perspiration. The hotter the weather the more the human being sweats. The hotter and drier the weather the more abundantly the trees and all vegetation give off water. If the man brings with him a sufficient supply of water or can drink from a nearby spring when he is thirsty, all is well with him. A tree, however, cannot fetch water from a distance nor yet go after it, but rooted to the spot it must supply its needs from the soil at its feet, and if it cannot get enough water to balance the amount given off from the foliage it must suffer.

Few of us realize, I think, the helplessness of the tree in the matter of adapting itself to meeting extreme conditions and we fail to appreciate the importance of assisting the tree where possible by our own intelligent efforts at these critical times. A tree gives off a surprising amount of water on a hot, dry day and is almost as much at the mercy of the atmosphere, as far as anything it can do to stop this rapid loss of moisture, as Monday's wash flapping in the sunshine on the clothesline. Dr. Ward, in England, once estimated that a single oak tree gave off through the foliage during five summer months over 600 barrels of water, and a birch tree on a hot summer day was found to transpire to the extent of 14 to 18 barrels in 24 hours. According to this an acre of such trees would give off nearly 8,000 barrels in the course of a season. It has been figured that the grass in a hay field will give off six and one-half tons per acre daily average through a summer. I have not come across estimates on the water loss from fruit trees, but it is certainly probable that their rate of transpiration is not vastly different from that of other trees. To replenish the loss of water vapor from the leaves is the task which falls upon the root system. Under ordinary conditions the roots can meet the demand on them very well, but under drouth conditions let us see what happens.

Normally the growth and development of the root system keeps pace with that of the top of the tree and supplies that top with the amount of moisture required. The root system, however, cannot rapidly increase its rate of development to meet sudden and severe or prolonged periods of high foliar water loss with entire success, and under climatic conditions which tend to exhaust the soil moisture rapidly without replenishment a task may be set for the root system which it is

utterly incapable of performing. Then, like the harvest hand in our illustration, the tree must suffer, and the hotter the days and drier the air and soil the more pronounced become the outward evidences of that suffering.

Let us look at some of the effects on the tree of giving off water faster than the roots can easily replace it. First, there is a more or less wilted appearance or rolling of the foliage, especially noticeable in the afternoon when the thirst is greatest. This may, gradually become a fixed condition and the prune trees may show what growers term leaf roll, or sometimes leaf curl, and this persists perhaps through the balance of the season. Drouth is not the only cause of this phenomenon. Anything which interrupts or restricts the water supply to all or to any part of the top like root rot, borers, winter injury, and most commonly of all, heart rot may cause this appearance. Not only do the leaves roll up, but they also tend to assume a yellowish cast, and in the severest cases this may be followed by a dropping of leaves, which results in a reduction in the evaporating surface of the tree and helps in this way to preserve its life.

Now it appears to be self-evident that the trees which commence a season by developing a large top and abundant foliage will, unless they have an unusually extensive root system and a deep, water-retentive soil on which to draw, will suffer more in a season when the water supply is low and the rate of transpiration high than trees that enter the summer with a more moderate amount of foliage. The same principle holds with different seasons. In a year when abundant soil moisture and plenty of warm days early in the season induce a heavy foliage and shoot growth the effect from a later drouth period is much more severe than in years marked by early drouth with its natural retarding effect on leaf and twig development.

In 1918 in the Pacific Northwest the dry weather struck us at the very outset of the season, thus checking to some extent what might otherwise have been a very heavy production of new foliage. In view of the unparalleled long continuance of the drouth this was probably more fortunate than otherwise, for the trees had a chance to adjust themselves at the beginning to the sort of climate which was to follow. Had this not been the case it is very likely that far greater damage would have resulted than orchardists actually experienced. As it was, prune men saw a heavy set and rapid development of the fruit. The trees paid more attention, as it were, to fruit production than to foliage production. As the season wore on, however, the warm, dry, bright weather continued practically unabated, gradually depleting the moisture from the soil without material help from precipitation in most sections. This brought on a time of testing. The tremendously active evaporation from the trees demanded heavy supplies of moisture from the roots. Eventually the demand became in some orchards greater than the roots of some of the trees could

supply, and evidences of trouble began to assert themselves.

It was some of the prune growers, I think, who first noticed trouble. During the last week in July and the first day or two in August there was, at least in the central Willamette Valley, a marked increase in the prevailing maximum temperature. This placed a critical strain on the orchards, and within a very few days specimens of diseased prune fruits in considerable numbers were sent to the office of the Plant Pathologist at the Agricultural College and reports of damage came in from widely-separated points in Western Oregon. My own opportunity for securing a thorough knowledge of the situation was limited by the lack of an opportunity to visit the orchard districts, but from the information obtainable it was evident that considerable losses were being experienced here and there, although there were many orchards that seemed scarcely to have been affected.

The first conclusion of the orchardists was that some sort of parasitic disease had struck the prunes. Careful examination of the specimens received indicated that such was not the case. It was very evidently some sort of non-parasitic trouble. The specimens showed varying degrees of injury. In some cases the prunes were affected by what I have called, for want of a better term, "gum spot." Examination shows the exudation of gum through the skin of the green prune in one or more places or the collecting of gum within the flesh in spots which have a watery look through the skin. Cutting the fruit open we find little brown specks in the flesh always, or nearly always, in the region of the network of veins or sap conducting vessels lying a slight distance under the skin. It is evident that some force has caused a collapse or rupture of some of the cells, and that this has been accompanied by the formation of more or less colorless gum which may accumulate in sufficient quantity to break through the skin under pressure and form on the outside as a glistening bead. This sort of trouble had been met with the season previous, which had also been unusually dry, but in 1918 the amount of broken-down tissue within the fruit seemed on the average much greater than before.

Most of the specimens received, however, showed a much more severe effect. The surface of the prune turned dark colored as though prematurely ripening. Irregular depressed areas were present over a greater or smaller portion of the fruit surface and gave the fruit an unnatural, corrugated appearance. Upon opening up the flesh it was found to be brownish underneath the depressed spots, this browning of the tissues varying in amount from a small spot on one side of the fruit to a discoloration which might involve nearly the entire flesh. These tissues almost invariably gave off a disagreeable fermented or acid odor and the taste was extremely unpleasant. Study of the tissues showed a breaking down more

Continued on page 24.

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Spraying

Specially written for Better Fruit by Thos. C. C. Scott, Commercial Orchardist of Stoke, Nelson, New Zealand, and revised by a Government Orchard Instructor, with an explanatory paragraph.

SPRAYING is of the utmost importance and of the greatest necessity in our orchard work, and the question arises: Can we obtain absolutely clean crops by correct spraying? Have we arrived at anything like a systematic scheme to cope with *all* the diseases in as economical manner as possible?

A brief paper on New Zealand methods, more particularly those obtaining in the Nelson district, where the biggest orchards of the Dominion are, may interest readers of BETTER FRUIT and will form an interesting subject for comparison with spray programs in vogue in the United States.

The writer has sprayed for the following diseases: Scab, powdery mildew, shot-hole fungus, coral spot, monilia fructigena or brown rot of plum and peach, bladder plum, leaf curl, codlin moth, leaf roller, woolly aphis, peach aphis, apple aphis (green), red spider and brown mite, San Jose scale and mussel-shell scale.

San Jose scale and mussel-shell scale have entirely disappeared, having given way to Gargoyle prepared red spraying oil and lime-sulphur.

Codlin moth and leaf roller are kept right under with four to five sprayings of arsenate of lead. The aphides and mites are kept under with prepared red spraying oil, Black Leaf 40 or lime-sulphur, and the fungoid diseases are kept in check by a special program of lime-sulphur or bordeaux.

The Stoke Fruit Growers' Association has conducted experiments for three years past and has achieved considerable success, so much so that the writer for two years past has been able to use a fixed program under varying conditions with entire success, and wherever this program has been carried out very high percentages of perfectly clean fruit have been obtained.

I find the best time to check woolly aphis, on varieties subject to this blight, is to spray with Gargoyle prepared red spraying oil 1-60 immediately the crop has been gathered.

The spray program, of course, must be carried out in a most perfect manner. There must be correct strength of material, correct times of application, a good brand, high pressure (200 pounds), suitable weather conditions, correct nozzles, suitable water, correct care of tree, such as pruning and cultivation, and, last but not least, thorough application.

The most important sprayings are the delayed dormant, the pink and the calyx for scab. The pink spraying is the most important, as the spot fungus is most active at this period, although it begins spore activity as soon as the buds begin to open in the spring, when an application called the delayed dormant will do an immense amount of good, as proved by experiment in my orchard last year and by experiment in Hood River Valley, Oregon.

An important feature in the spray program is the combining of lime-sulphur with arsenate of lead. This has been quite successful for three years past without burning or deterioration in results. Black Leaf 40 has occasionally to be added for woolly aphis if bad in late summer. This cleans the trees up considerably before picking time.

I proceed as follows in mixing lime-sulphur with arsenate of lead:

In one four-gallon bucket dilute the lime-sulphur to be used to that extent, four gallons. Next slack three pounds quicklime and dilute to four gallons. This is poured off into another four-gallon bucket containing three pounds of arsenate of lead paste worked down to the consistency of thin cream. These two buckets, the dilute lime-sulphur, and arsenate of lead and limewater, are then poured into the spray barrel, running together; the spray barrel to contain a full supply of water. The lime used has a tendency to neutralize the burning effect of the water soluble forms of arsenic. I have had no burning through three years under all conditions.

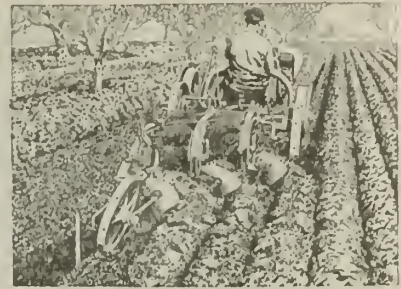
The following is the spray program used for apples and pears:

First application (delayed dormant). For scab, mildew and aphis. (Lime-sulphur 1-20 at 32° test.) If aphis bad, add Black Leaf 40, 1-1200.

Second application (pink). For scab and mildew. (Lime-sulphur 1-50 to 60.)

Third application (calyx). For scab, mildew and codlin. (Lime-sulphur 1-80 to 100.) Add arsenate of lead, 3 lbs. to 100, for moth.

Fourth application (ten days after calyx). For scab and mildew. (Lime-



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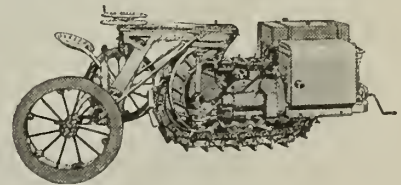
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sulphur 1-80 to 100). Add arsenate of lead, 3 lbs. to 100, with lime.

Fifth application (two or three weeks later). For scab, moth or woolly aphid. (Lime-sulphur 1-100 to 120). Add arsenate of lead, 3 lbs. to 100, with lime. Add tobacco if aphid shows.

Sixth application (two or three weeks later). For scab and moth. (Lime-sulphur 1-120). Add arsenate of lead with lime.

Seventh application (month later). For scab, moth, woolly aphid and leaf roller. (Lime-sulphur 1-120 if thought necessary). Arsenate of lead, 3 lbs. to 100, with lime. Add tobacco if necessary, 1-1200. Arsenate of lead is the principal spray at this application.

Eighth application (three or four weeks later). For leaf roller. Three pounds arsenate of lead, adding lime-sulphur if necessary.

Ninth application. A late spray with arsenate of lead, 3 lbs. to 100, just before picking keeps leaf roller in check for storing or exporting.

Tenth spray. Autumn oil 1-60 after crop removed on varieties subject to woolly aphid. (Gargoyle prepared red spraying oil used.)

The above has produced perfect results. Not 5 per cent of scab in a bad year and 100 per cent clean last season. This program will be carried out by me again this year.

Bordeaux 8-6-40 and 3-4-40 can successfully replace the first two sprayings for apples and pears.

Peach Leaf Curl.—For this disease I spray with lime-sulphur 1-10 at delayed dormant stage, and 1-25 when some blossoms are showing, and get perfect results. I have also used bordeaux 8-6-40 and 3-4-40 with a similar result.

In conclusion, I find a good power sprayer and a proper outfit is one of the chief determining factors in obtaining perfect success, also high pressure and thorough application.

DOMINION OF NEW ZEALAND
Department of Agriculture, Industries
and Commerce.

Horticulture Division.

Nelson, N. Z., Sept. 4, 1918.

The forty-acre orchard referred to in this article is on the eastern shore of Tasman Bay, on a strip of sloping land, half a mile or so wide, between a ridge of hills and the sea. It has a north-westerly outlook, and a dark, moderately heavy soil. Two or three degrees of frost may be experienced occasionally during winter, while the thermometer is rarely over 80° F. in the shade in summer. The annual rainfall is usually from 36 to 40 inches, and falls mostly with a northerly wind.

The varieties of apples grown in this orchard are chiefly Sturmer, Jonathan, Delicious, Dougherty, Rokewood and Senator. During the three years I have known the orchard Mr. Scott's spraying results have been unusually good, the sample being bright and clear and free from russet and stings.

WILLIAM C. HYDE,
Orchard Instructor.

Bean Double Giant

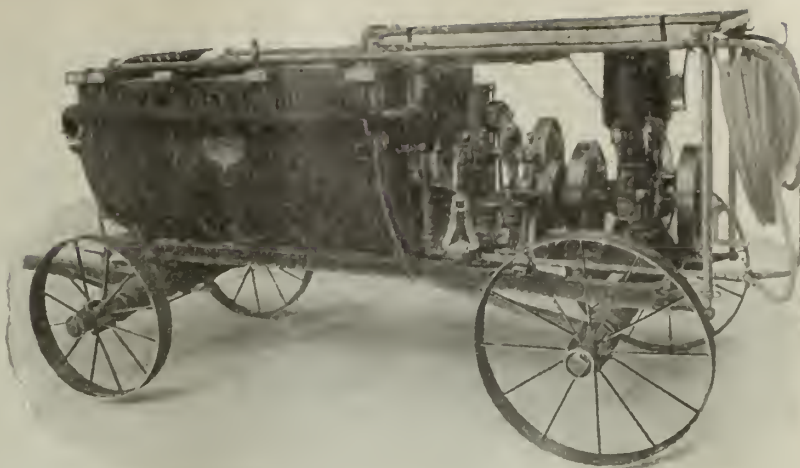
Capacity 25 gallons per minute, 400 lbs. pressure. Supplies 10 to 12 lines of hose.

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Capacity 8½ to 11½ gallons per minute, 200-250 lbs. pressure. Supplies 2 to 4 lines of hose.

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A line of spray outfits like the Bean can't be established in a day. Starting with a single barrel pump 34 years ago the Bean line has developed to its present completeness. Each new outfit has been built to meet a particular need and the high standard established at the beginning has been constantly maintained throughout the entire line. For 34 years we have specialized in the building of orchard sprayers. These years of experience, study, experimentation and practical work are back of Bean Sprayers. And, in sprayers, as in other machinery, steady development always means leadership.

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Bean Patented Threadless Ball Valves with Reversible Seats—Simply bell metal balls which cannot stick, corrode or give trouble. Reached in two minutes without stopping engine and withdrawing liquid.

Porcelain-Lined Cylinders—Cannot be injured by any liquid.

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Bean Power Sprayers are built like high-grade automobiles. Every part is accurately machined and finished—and every part fits its corresponding part perfectly. That's why they wear and wear after cheap assembled outfits have been consigned to the scrap heap.

Cheap outfits can always be had, but the best outfits are difficult to get at this time as the demand for them is stronger than ever. If you want a "Bean" investigate at once.

We carry extra large stocks of repair parts and extras in Portland and other Northwest points so as to take care of our customers and avoid delays in shipping.

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Send for Our Complete New Catalog of Hand and Power Sprayers, Spray Hose and Accessories. It illustrates and describes the entire Bean line, explains the many distinctive exclusive Bean features, and tells you everything you ought to know about spray pumps. Send the coupon—now. Also, see your nearest Bean dealer. We have representatives in all fruit-growing sections.

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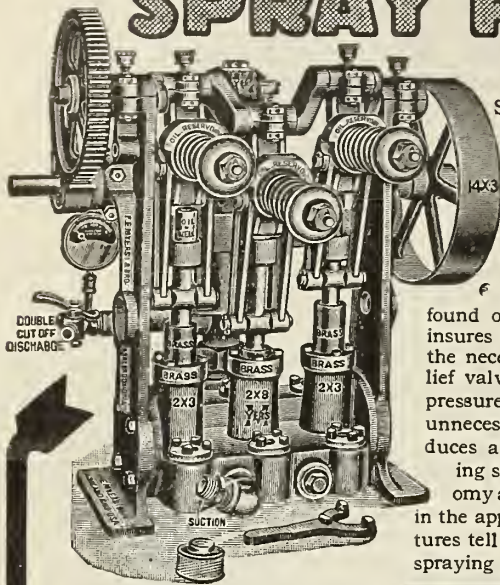
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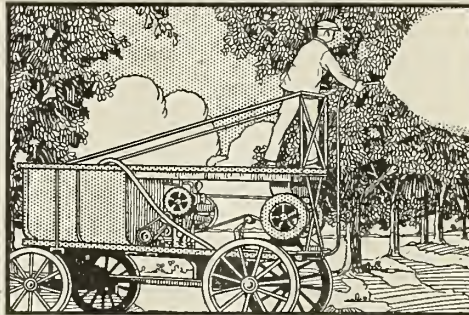


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WHEN WRITING ADVERTISERS MENTION BETTER FRUIT

Field Notes from Southern Idaho

E. F. Stephens, Nampa, Idaho

At this season of the year we are making preparations for the lime-sulphur spray and the effort to control the San Jose scale. We put our machinery in order, overhauling engine and pump, making sure that everything is in readiness, combining the wants of a large number of people for suitable insecticides into one contract and saving all of us something on the first cost and freight. Last season I combined the wants of about eighty orchards into one deal or rate, thus saving all of us some money. We have for many years handled the liquid lime-sulphur, in the manufacture of each barrel of which one hundred and thirty-four pounds of sulphur is used. This gives us a strength of 32 or 33 degrees Beame, and we use a solution of one to eight gallons of water. Liquid lime-sulphur is marketed in cumbersome heavy barrels weighing about 600 pounds each, awkward to handle and expensive to freight and move around the country.

On the other hand, the dry formulas of lime-sulphur are much more convenient to handle, less freight to haul and can be had in convenient size packages to suit the wants of the small customer as well as the large.

Unfortunately, the dry powders as sold and recommended in quantities the manufacturers suggest to use has not always entered into perfect solution and in the experience of two of our leading orchards the use of the dry powder has not been as effective in controlling the San Jose scale as the old-fashioned liquid solution. Those who have given this question very careful study are therefore still using the liquid solution.

Some weeks ago I received an offer from a firm and manufacturers of arsenate of lead offering the dry or powdered form at 20 cents a pound. A sample was sent for examination and test. This sample was referred to our state chemist at Boise, who found it satisfactory in arsenical composition, stronger

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LIEUT. CHARLES M. SIMONS

Of the firm of Garcia, Jacobs & Company
Covent Garden, London.

At the convention held in Philadelphia in August of the International Apple Shippers' Association Lieut. Simons was appointed vice president for Great Britain. Lieut. Simons has frequently visited the United States and it is his intention to come here during the coming summer.

than the recommended formula. Unfortunately, on testing it out in suspension in water this product did not remain in suspension in water for such length of time as would enable it to compare on equal terms with other long tested recognized brands. While the price was very attractive, we do not dare use it in our own work or recommend it to others. Under present conditions of labor the cost of application is a very important element to consider and we should use such insecticides as are most likely to give satisfactory success.

There is not at the present time a sufficient amount of spraying machinery in use in Southern Idaho to cover all of the orchards in a suitable manner in good time. Failure means defective fruit, largely increasing the cost of grading besides changing commercial grades into cull apples.

Our experience leads me to suggest early preparation of suitable machinery and contracting for spray material.

I also wish to caution fruit growers against the work of field mice, which are just now quite destructive in some orchards. Clover or weeds about the trunk of the tree act as a screen protecting the mouse from owls and hawks. One party near Meridian has already had two hundred trees girdled. We find it necessary to rake and pull grass or weeds away from the trunk of the tree, that the mouse may not find shelter, and where this precaution has been taken the mouse is not likely to girdle the tree unless a considerable amount of snow comes to hide the mouse from his enemies.



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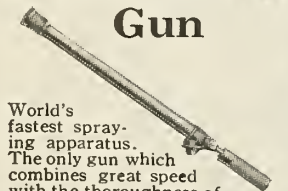
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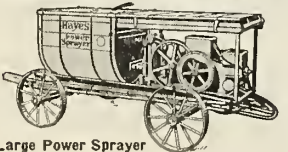
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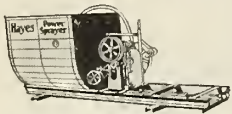


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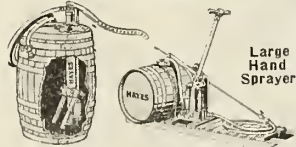
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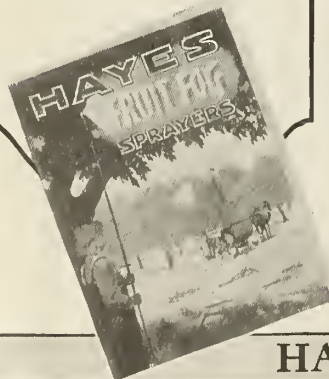
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No matter what you need from our great Triplex Fruit-Fog Power Sprayer to the smallest garden atomizer, we have it.

Hayes Sprayers for hand use have been designed for ease of operation, high pressure and enduring service. In the larger hand outfits as well as the smaller atomizers the work of experts is evident.

You get the best and quickest results with the least physical effort. This is an important feature where your work is not large enough to warrant a power outfit and must be done by hand.

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Ask Mr. Favor

Mr. E. H. Favor, head of our Horticultural Department, is a nationally known expert on fruit raising and spraying. For many years he was the editor of one of our leading fruit journals. He was also associated with two state experimental departments, engaged upon important scientific work. Mr. Favor's experience and knowledge are at the disposal of any person interested in spraying. This does not mean users of Hayes Apparatus alone. It means you no matter where you live or what apparatus you use. If you have any problem bothering you—any question you want answered about orchard, garden or farm work, just "Ask Mr. Favor!" He will answer you in a person-to-person letter.



BETTER FRUIT

An Illustrated Magazine Devoted to the Interests
of Modern Fruit Growing and Marketing.
Published Monthly

Better Fruit Publishing Company

407 Lumber Exchange
PORTLAND, OREGON

The 1918 Apple Crop of the Northwest.—The total estimate for the 1918 apple crop has been issued by the Bureau of Markets, Department of Agriculture. The entire crop of the United States will be about 25,404,500 barrels, which is an increase of about 13 per cent over last year. This increase is due to the heavy production of barrel apples, which shows an increase of 31 per cent over last year, but the production of box apples will show a decrease of more than 4,000,000 boxes, or 17 per cent.

The State of Washington will ship around 17,180 cars of 756 boxes each. This is practically 5,000 cars less than produced in 1917. Wenatchee will produce about 8,400 cars, which is very little less than last year. The total crop of the Yakima Valley is estimated at 7,600 cars, or about 900 less than 1917. The crop of Hood River is one of the largest ever produced, amounting to about one and one-half million boxes, which is nearly half a million more than last year. In all other fruit districts of Oregon the apple crop is light, probably not half of last year's production. Idaho has suffered the most severe loss of any state, which was caused by early frosts. The crop will not amount to 500 cars, as compared to 3,500 in 1917.

Colorado will ship about 1,800 cars, the greater portion of which will be moved in bulk. The Bitter Root Valley of Montana will ship almost the entire crop of Montana, consisting of about 300 cars. The crop of Utah is estimated at 600 cars.

The Value of an Orchard.—The fruit industry is coming back to its own. Growers are learning that the secret of the success of the fruit industry is not just obtaining a very high price, but much of the success depends on the marketing. Fruit growers have made big money and have every confidence that the fruit business can be and will be put on a stabilized basis, and net the grower a good income on his investment. Recently in the Yakima district offers were made of \$1,000 per acre on three different orchard tracts, which were refused. This is evidence that the owners feel there is a big future for the fruit industry.

Steel Strapping.—Recently tests have been made regarding what additional strength was afforded by the use of steel strapping. In boxes of canned goods if a steel strap is added four inches from each end of the box its capacity to stand rough usage was shown to be more than trebled, while a box 16x16x36 inches, carrying a 350-pound load, could be cut 25 per cent in quantity of material without loss of

carrying strength by the addition of straps placed six inches from each end. This will give fruit growers some idea of the value of steel strapping for apple boxes where they may be subjected to rough usage or long trips, and particularly in export business. Where boxes of apples arrive in a broken condition and the apples are bruised it means a serious loss. The freight is just as heavy on a broken box of apples, the same amount of room is required, and the apples will not demand a high price like the apples arriving in first-class condition.

Mr. Gerald Da Costa, the well known fruit broker of Covent Garden, London, through BETTER FRUIT, sends the following message: "Cheeriest Christmas greetings to all of my friends in America, and best wishes for a very prosperous New Year." Mr. Da Costa is still in active service in France, but hopes to be released in the near future. It is his intention to make an early visit to the United States, and he is looking forward to meeting many of his friends.

The report on cold storage holdings December 1, for the entire country, show a decrease over last year. The total amount of box apples will show a slight increase, but the Northwestern holdings show a decrease of about 11 per cent than for the same date in 1917.

Better Marketing and Distributing

BETTER FRUIT, Portland, Oregon.

Enclosed find \$1.00 as renewal of my subscription to BETTER FRUIT. It seems to me that we must now have better marketing and distributing of fruit, as the producers have generally made good in the matter of better fruit.

We have fought the vermin and the disease, and graded and packed our fruit in scientific and attractive packages. But after we have "delivered the goods" we often find ourselves up against a primitive, unscientific and barbaric method of marketing the stuff and distributing it, whereby the consumer pays too much and the producer gets too little for his work.

BETTER FRUIT ought to start a campaign persistent and relentless against all the pests and parasites of market and distribution until these shall be as clean and attractive and satisfactory as our fruit itself.

There should be more of our first-class pome fruit on the family dining tables, in the restaurants and hotels of the cities. You seldom see good apples on the tables in Portland, but often see there a lavish display of citrus fruit from California. From that state we also here in Oregon and Washington get carloads of canned and dried fruit, while a large amount of our own is allowed to go to waste. There ought to be a remedy for all these things and BETTER FRUIT and our scientific experts ought to point the way.

Yours for better fruit, better markets, better distribution, better saving of by-

products, better returns to the grower, better papers, better world and better men everywhere.

H. V. ROMINGER.

Underwood, Washington.

Your letter contains material for many long articles for BETTER FRUIT and we can only touch lightly on a few of the most important topics mentioned. First of all, the growers themselves have much to do. There is altogether too large a percentage of fruit entering our markets in a poor physical condition, poorly packed, not well graded, and often very imperfect, due to attacks of insects and diseases. One has only to visit our wholesale and retail markets in the East to know that this condition is true. Our local markets on the Pacific Coast are vastly superior in this respect to the large Eastern markets, where one will see a large percentage of the apples offered to the market in such poor condition that they would make doubtful hog food. Despite the wonderful progress we on the Pacific Coast have made on grades and grading, we are a long way from having our grades standardized, and it is to be hoped that the Pacific Northwest, at least, in the very near future may be able to unite on standard grades.

We realize that many factors connected with marketing are far from satisfactory and much needs to be done to protect both grower and consumer. Happily, however, we have made much progress in marketing. The establishment of the Fruit Growers Agency, Inc., of the Pacific Northwest, while not doing so much perhaps directly in itself, has, however, accomplished a great work indirectly, as it has been a vehicle through which we could come in close contact with the Office of Markets of the United States Department of Agriculture. As a result we have fewer organizations attempting to sell fruit, we have more stronger local organizations, we have eliminated to a very large extent the cut-throat practices which our various selling organizations formerly engaged in. We have secured a much wider distribution of our fruit, and we have been able to receive daily market reports, climatic reports, etc., all of which have been of great help to the growers of the Pacific Northwest. All growers should belong to some local association. The local association, in turn, if not having a very large tonnage, should confine their efforts to good physical handling and should affiliate with some strong marketing agency. We all realize that there are many evils connected with marketing that should be corrected. Fortunately, we are correcting some of these and ultimately we may hope to correct them all. BETTER FRUIT is ever anxious to do everything in its power to improve the marketing conditions for the growers. One of the greatest sources of trouble, however, and one of the hardest factors to handle is the independent grower, who often recognizes no standard grades, persists in consigning his fruit too often to men of unknown reputation and who later may prove to be rascals.

We have realized that there is altogether too small a consumption of apples. As our population increases we should eat more and more apples; on the contrary, we find that we are eating less. Not enough has been done to correct this evil. We need a campaign to carry on advertising and publicity, a well organized campaign to help in this education. Some splendid work has been done by the advertisers of the Rosy Apple of Hood River, the leading brands of Wenatchee and Yakima, the well known Skookum Brand, and with such productions as Phez, Loju and Appleju. A committee was appointed from Oregon and Washington last summer to try and get the co-operation of the entire Northwest in a campaign to increase the consumption of apples. The matter, we believe, was finally referred to the Fruit Growers Agency, Inc., but seemingly up to the present very little has been accomplished. It is to be hoped, however, that something definite and concrete may be accomplished this coming year. We have been too content to allow fruit to be spoken of as a mere tonic, as a health preserver, and have not been persistent enough in educating the American public to the real food value of fruit, and especially apples. Our winter apples which reach the trade will rank high as a good, containing about 12 per cent sugar, and sugar is certainly now recognized as a food. We are not foolish enough to claim that it is a complete food, but we do believe that the American people have been educated to believe that milk, meat and bread are the essentials and that other things are largely luxuries. Even taking the old standard of protein, fat and carbohydrates, apples will compare very favorably indeed, with their 12 per cent sugar, and if one should go into the market with a nickel they could buy in

a big city like New York more real food than could be secured from fish, eggs, dried and smoked beef, and many others too numerous to mention, and would come surprisingly close to bread, milk and similar foods. Of late years our scientific investigators are showing that the old standard of food value is perhaps incorrect, as many of our raw foods, especially leafy vegetables, contain certain extracts which are absolutely essential to good health; that many foods which formerly showed a rather low food value on the basis of protein, fat and carbohydrates now have a very high food value owing to certain essential extracts which they contain. We need to organize ourselves in such a way as to be able to present these facts before the American public, to conduct a campaign which will increase the consumption of apples.

We have made wonderful progress in the canneries, juice factories, dehydrators, etc. A few years ago we probably had two or three such plants, the total output of which would probably not be \$100,000. Now we probably have fifty plants whose total output would reach many millions. We will probably continue to import from California dried fruits which we cannot ourselves supply, such as raisins, sweet prunes, figs, peaches, apricots and certain other products. The Northwest, however, will continue to become a greater and greater exporter of canned products. What we perhaps need more than anything else is some law to prevent concerns operating in the Pacific Northwest putting up millions of dollars worth of products and advertising and selling the same as California products. A number of resolutions have recently been passed by horticultural societies and other associations asking that our Legislature pass such laws prohibiting such practice. Let us work together and perhaps we can do much to accomplish some of the many things which we need to have done. BETTER FRUIT will always be found a champion of any movement that will aid the fruit industry of the Pacific Northwest.

The MacMillan Company, 66 Fifth Avenue, New York, has recently published two books that will prove very instructive to many fruit growers. "Peach Growing," by H. P. Gould, pomologist in charge of fruit production investigations, Bureau of Plant Industry, is the title of one, and this work covers the general field of growing peaches and placing them within the reach of the consumer. One chapter on orchard management deals with such problems as tillage, cover crops, green manure and shade crops, fertilizers, pruning and the control of insects and diseases.

"Manual of Vegetable Garden Insects," by Cyrus Richard Crosby and Mortimer Demarest Leonard, is the title of the other book recently published. This deals with the principal insects which attack truck and vegetable crops, and deals largely with the methods of control. The last chapter deals quite fully with insects and insecticides.

Beforehand Information

"It's better to be safe than sorry" may be an old saying but it is particularly true about tree sprays.

If all you do throughout the year is according to the best orchard practice, and you use an inferior material for spraying, not only next year's crop may be a failure, but the trees may be permanently injured.

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Not only do we maintain a scientific laboratory for testing tree diseases and experimenting on how to prevent their development, but part of our service to the fruit growers of the Pacific Coast is by personal contact.

Our entomologist, Mr. S. W. Foster, is constantly traveling through the orchard sections, devoting his time to the fruit growers. His long experience, and his scientific training, are at your service.

Write to him fully about fruit tree troubles. You will find his reply to be helpful and authoritative. Address him in care of this office. Your letter will be forwarded to him. If he is in your neighborhood he will call to see your trees.

We issue bulletins on tree diseases and their remedies. Write for the one in which you are interested.

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The next few issues of BETTER FRUIT will contain timely articles on the subject of spraying.

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Anthracnose Control on Black Raspberries

[Editor's Note.—Professor W. C. Dutton, of the Michigan Agricultural College Experiment Station, has recently published a bulletin on "Anthracnose Control on Black Raspberries." By request of some of our subscribers we are hereby publishing this article, which will be valuable and instructive to many of our readers.]

THE Horticultural Department began work in 1914 to determine the relative efficiency of various spraying materials to control anthracnose on black raspberries.

In 1914 and 1915 this work was done at Eaton Rapids in a field of Plum Farmer belonging to T. A. Farrand. The bushes were several years old. Proper pruning and cultivation were practiced regularly.

Four materials, as follows, were used: Lime-sulphur.

Soluble sulphur, a proprietary compound manufactured by the Niagara Sprayer Company.

Copper sulphate solution. Bordeaux.

Each material was used for the different application as listed below:

Lime-sulphur—Dormant, 2½ gallons in 50; summer, 1½ gallons in 50.

Soluble sulphur—Dormant, 10 lbs. in 50; summer, 1 lb. in 50.

Copper sulphate—Dormant, 3 lbs. in 50; summer, 1 lb. in 50.

Bordeaux—Dormant, 4-4-50; summer, 4-4-50.

The rows were forty rods long. Alternate rows were sprayed, one with each material. The other rows were left as checks. The arrangement of the plots is shown in the accompanying chart. The rows were not sprayed their full length, except the lime-sul-

phur row, which was sprayed entirely for the dormant application only, as shown in the chart of the plots.

1. Lime-sulphurX.....
2. UnsprayedX.....
3. Soluble sulphurX.....
4. UnsprayedX.....
5. Copper sulphateX.....
6. UnsprayedX.....
7. BordeauxX.....
8. UnsprayedX.....
9. UnsprayedX.....

In 1914 three applications were made as follows:

First, April 4—Dormant application.

Second, May 28—New shoots about 18 inches high.

Third, August 26—Old canes had been cut out.

In 1915 three applications were made at the following periods:

First, April 17—Dormant application.

Second, May 19—New shoots were 6 to 10 inches high.

Third, June 14—Blossoms off. Shoots about two feet high.

No later applications were made, as the bushes were to be pulled out after the berries were harvested.

After the last application on August 26, the new canes in all plots were examined carefully and canes selected which seemed to be average ones for each plot. The canes from the different plots were then compared.

In all plots, sprayed and unsprayed, there was some anthracnose near the tips of the canes. The amount varied in different plots. The unsprayed plot showed most and the lime-sulphur plot least. This condition was probably caused by an infection during a period when the tips of the canes were not covered with spraying material.

There was a very marked difference in the condition of the lower parts of the canes. The canes in the row sprayed with lime-sulphur were practically free from anthracnose except a few spots near the tips. The portion of the row which had only the dormant application was in as good condition as the part sprayed three times.

In the row sprayed with soluble sulphur the canes showed much more anthracnose than where lime-sulphur was used. Bordeaux mixture gave poorer results than soluble sulphur and the row sprayed with copper sulphate solution was little better than the unsprayed row. Practically all the canes in the unsprayed row were quite badly affected. The upper and lower parts of canes showed about the same amount of the disease.

The condition of the new growth was noted about the middle of August.

In the unsprayed row nearly all the canes showed some anthracnose, most of them quite badly. The spots were much more numerous near the base than at the tips of canes.

Three applications of lime-sulphur gave better results than any other material. The results were uniformly good and very few of the diseased

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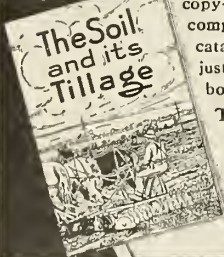
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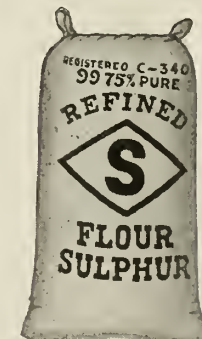
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spots could be found on any of the canes in the plot. Where but one spraying was made the disease was not serious, but of course more common than when more treatments were applied.

Bordeaux mixture gave nearly as satisfactory results as three applications of lime-sulphur so far as the canes were concerned, but the foliage was quite badly burned by the last application.

Soluble sulphur did not give as satisfactory results as lime-sulphur or Bordeaux mixture.

Where copper sulphate solution was used anthracnose was nearly as abundant as in the unsprayed row. The foliage was burned quite badly by the summer application.

Three applications of lime-sulphur gave very satisfactory control of anthracnose in both 1914 and 1915 without any indication of foliage injury.

One dormant application of lime-sulphur gave good control in 1914, but was not so satisfactory in 1915.

Soluble sulphur did not give satisfactory control, although the disease was checked to some degree.

Bordeaux mixture gave fair control in 1915, but not in 1914. When made by the 4-4-50 formula it is not always safe to use because of foliage injury.

Copper sulphate solution failed almost entirely to control the anthracnose. It also burned the foliage quite badly.

The raspberry spraying experiments were continued in 1917 at Leslie in a field of Plum Farmer belonging to E. W. Potter.

The plants had been set five years and were quite badly diseased with anthracnose. There were sixteen rows about twenty rods long.

Materials used: As the results obtained at Eaton Rapids in 1914 and 1915 indicate quite strongly that lime-sulphur will give as good or better results than any of the other materials used,

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no other material than lime-sulphur was used in the experiments in 1917. The object of the work was to determine how many applications are necessary to give satisfactory control of anthracnose.

Applications were made at three periods and are designated as follows:

1. Dormant. Before growth started.
2. First summer. When new shoots were six to ten inches high.
3. Second summer. Just before the blooming period.

For the dormant application the lime-sulphur was diluted at the rate of 2 gallons in 50, and for the summer applications at the rate of 1 1/4 gallons in 50.

The field was divided into six plots, each plot being sprayed at the periods indicated below. Each plot consisted of three full rows except the unsprayed plot, which had only one row.

Plot 1—Dormant application only.

Plot 2—Dormant and first summer applications.

Plot 3—Dormant, first and second summer applications.

Plot 4—First and second summer applications.

Plot 5—First summer application.

Plot 6—Unsprayed.

The control in 1917, even when three applications were made, was not quite so good as was secured in 1914 and 1915, with three applications of lime-sulphur. There was a rank growth of June grass well up around the canes. The soil between the rows was cultivated, but the grass in the rows was not cleaned out. This condition was undoubtedly responsible for the poorer control, as moisture was held in the rank growth of grass.

In spite of the unfavorable conditions the control in some plots was very satisfactory. It had been planned to make definite counts of diseased canes by the undesirable cultural conditions. A general statement of the condition of the canes in each plot follows:

Plot 3, which was sprayed three times, showed very little anthracnose.

Plot 2, which had the first two applications, and plot 4, which had the second and third applications, both showed slightly more anthracnose than plot 3.

Plot 1, which had only the dormant application and plot 5 only the first summer application, were diseased somewhat worse than plots 2 and 4, but their condition was much better than that of the unsprayed row.

In the unsprayed row nearly all the canes were badly spotted with anthracnose.

Three applications gave satisfactory results. Two applications, regardless of the time made, failed to give results as good as were secured with three applications. One application, either before or after growth started, showed some results, but not so good as when sprayed a greater number of times.

The results of these experiments show that anthracnose on black raspberries can be satisfactorily controlled with lime-sulphur. To insure success at least three applications should be made, as follows:

First—In spring before growth starts. Use lime-sulphur diluted at the rate of 2½ gallons in 50.

Second—When new shoots are six to eight inches high. Use lime-sulphur diluted at the rate of 1¼ gallons in 50.

Third—Just before blooming period. Use lime-sulphur diluted at the rate of 1¼ gallons in 50.

Clean cultivation should be practiced. Weeds in the rows will hold moisture, making conditions favorable for anthracnose development. The bearing canes should be removed as soon as the fruit is harvested.

Credit is due T. A. Farrand of Eaton Rapids and E. W. Potter of Leslie for their co-operation in this work.

Dry Sulphur Preparations vs. Lime-Sulphur Solution

Insecticide and Fungicide Laboratory, Agricultural Experiment Station, University of California (Berkeley), Nov., 1918.

THERE are two types of dry sulphur compounds on the market as substitutes for the well-known commercial or home-made lime-sulphur solution. The many conveniences in marketing and handling a dry substance are self-evident, but should not be taken advantage of at the sacrifice of efficiency. The additional cost of convenience is a point that must be decided by the user himself.

If intended for use as a winter spray against scale insects, a sulphur preparation is evaluated on the basis of the percentage of sulphur combined in the form of polysulphides and thiosulphate. The uncombined sulphur might also be included in the evaluation of these products when they are to be used against red spider, mildew or other pests for which sulphur is known to be effective.

The following will indicate the amount of the dry preparation to use as the equivalent of one gallon of commercial 33° Beaume lime-sulphur solution. In order to give the dry materials the benefit of the doubt, the uncombined sulphur is included in the calculations. The figures are based on analyses made by the laboratory.

MATERIAL	Total Active Sulphur (Approx.)	Cost of 100 lbs. Active Sulphur	Amount Equivalent to 1 gallon Lime-Sulphur Solution 1 gal. weighs 10.78 lbs.
Lime-sulphur solution (33° B.)	26%	\$ 8.03	10.78 lbs.
Average retail price \$11.26 per barrel.			
Soda-sulphur	57%	14.03	4.9 "
Average retail price \$8.00 per cwt.			
Lime-sulphur (dry). . . .	55%	18.90	5.0 "
Average retail price \$10.40 per cwt.			

Soda-Sulphur.

One of these types may be spoken of as alkali polysulphides, of which Niagara soluble sulphur compound may be taken as typical. Older materials of this type are sold under the names "Sulphide of Soda," "Sulphide of Potash," "Liver of Sulphur," etc. The alkali polysulphides are compounds of either soda or potash and sulphur. These appear to be effective as a substitute for lime-sulphur solution. Aside from convenience in handling, they possess advantages over lime-sulphur solution as follows:

Soaps can be used with them as a spreader if desirable.

They are also compatible with soap-oil emulsions.

Did You Read the Article on NITRATE OF SODA

Experiments in December Issue
Better Fruit Covering Report of
Gordon G. Brown, Horticulturist
Hood River

He reports: * * * Response from the use of two successive annual applications Nitrate of Soda fertilizer in early March of five or six pounds per tree was at once very satisfactory in that trees quickly regained their lost balance. * * * The percentage of fruit set *doubled and trebled in many instances* while larger yields of better fruit were in proportion. * * *

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Orcas Lime—Fruit Spray Lime

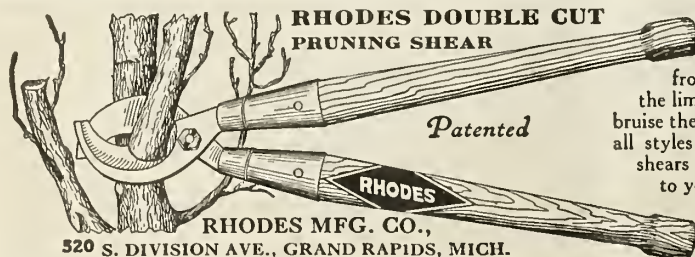
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The most important disadvantage is the fact that they cannot be used with lead arsenate as a combination spray. When used on foliage they are somewhat more caustic than the lime-sulphur solution.

Summarizing the above, it appears that the alkali polysulphides are effective, convenient, and have some advantages over lime-sulphur solution and some disadvantages. Taking everything into consideration, these compounds do not possess enough advantages to warrant using them in preference to the older well-established and standard lime-sulphur solution, except in some cases as a combination spray.

Dry Lime-Sulphur.

Samples of this material have been analyzed by the laboratory and found to contain the same constituents as lime-sulphur solution, that is, polysulphides and thiosulphate of lime. In addition, however, they contain about 20 per cent organic matter. The material does not go entirely into solution in cold water and there is some free sulphur.

So far as can be judged, the dry form of lime-sulphur when dissolved in water will produce a spray in all respects similar to the usual dilution of lime-sulphur solution, provided equivalent quantities are used. The chief point for consideration, then, in choosing between the dry form and the solution, is the cost. Comparative costs are shown in the table above.

If the manufacturer's directions for winter spraying are followed (10 to 12 pounds of dry lime-sulphur dissolved in 50 gallons of water) a spray will be obtained containing only about one-half as much active sulphur as in the customary 1 to 10 dilution of lime-sulphur solution. In defense of this half-strength recommendation the manufacturers say that certain organic material which is incorporated into their dry compound prolongs the effectiveness of the applied spray so that much less than the usual amount of sulphur is required. A somewhat similar claim is made by the manufacturers of soda-sulphur compound. Field tests have not been made in California to determine whether or not these claims are valid.

This laboratory, therefore, will still continue to evaluate these and similar preparations of sulphur on the basis of the percentage of sulphur combined in the form of polysulphides and thio-sulphate.

The fruit growers of California cannot afford, for the same of convenience, to set aside a well-established and thoroughly-tested spray practice and reduce their remedies to half-strength unless this has been shown to be feasible by experiments of the most convincing sort. It would be better to use full-strength at double the cost.

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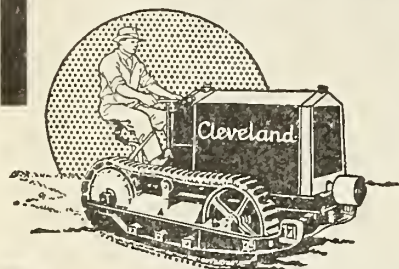
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all admit that the greater part of farm work--discing, harrowing, cultivating, seeding, manure spreading, etc., must be done on plowed or soft ground--also in plowing the low soft spots and hill-sides must be considered.

Then in orchard work another requirement enters--making short

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Some Prune Fruit Troubles, Etc.

Continued from page 8.

or less like that in the gum spot condition, but in extensive areas. No parasite was evident in the tissues and such fruits kept for weeks in the laboratory showed no increase in the size of the affected areas, which would certainly not be the case if it were a true rot. The question naturally arises as to the cause and nature of the injury.

The circumstantial evidence points, I think, to a connection between these somewhat puzzling troubles and the drouth conditions of the season. At certain critical times it would seem that the water drawn out of the foliage on hot days was probably more than the root systems of individual trees in many of the orchards could successfully replenish, and this does not necessarily imply that the soil was down to the lowest ebb of moisture content at such times. It simply means that under the conditions the demand was greater than the supply.

In orchards where the soil was poorly cared for and excessively dry, or where the soil was shallow, more trouble was reported than from soils that were deeper or better cared for. Hilltops suffered more than lower levels in many cases. Here extreme transpiration conditions naturally prevailed. Yet trouble was also experienced on well tilled soil and even on land that had been irrigated. Mr. C. E. Stewart, in Lane County, reported on an orchard where the trees that had received one irrigation early in July were nearly all affected later on. In this instance the soil was more or less gravelly. If my analysis of this situation is at all correct, the trees were probably stimulated to abundant new growth by the early irrigation. Then when the critical time came the total draft of moisture from the heavy tops was greater than the roots in the gravelly soil could meet. In a very old orchard not far away, with much better soil conditions, the trees met the demand without any effect on the fruit even in two rows which had received irrigation. As would be expected with the variation in root systems and in soil conditions the individual trees in many orchards showed great differences in the amount of injury present. Some trees lost nearly all the crop, others half the crop, while even in the worst orchards there were usually scattered trees which showed little or no effects. Orchards with trees close together, where there was great competition for soil moisture on the part of the root systems, often showed considerable damage.

The conviction that there is a real connection between the dry season and the prevalence of these fruit troubles is considerably strengthened by the interesting discoveries which certain investigators have made in the last few years to which I wish to call your attention. Dr. W. H. Chandler, working in Missouri on the water relations in various fruits, found that when the normal water supply of a fruit-bearing

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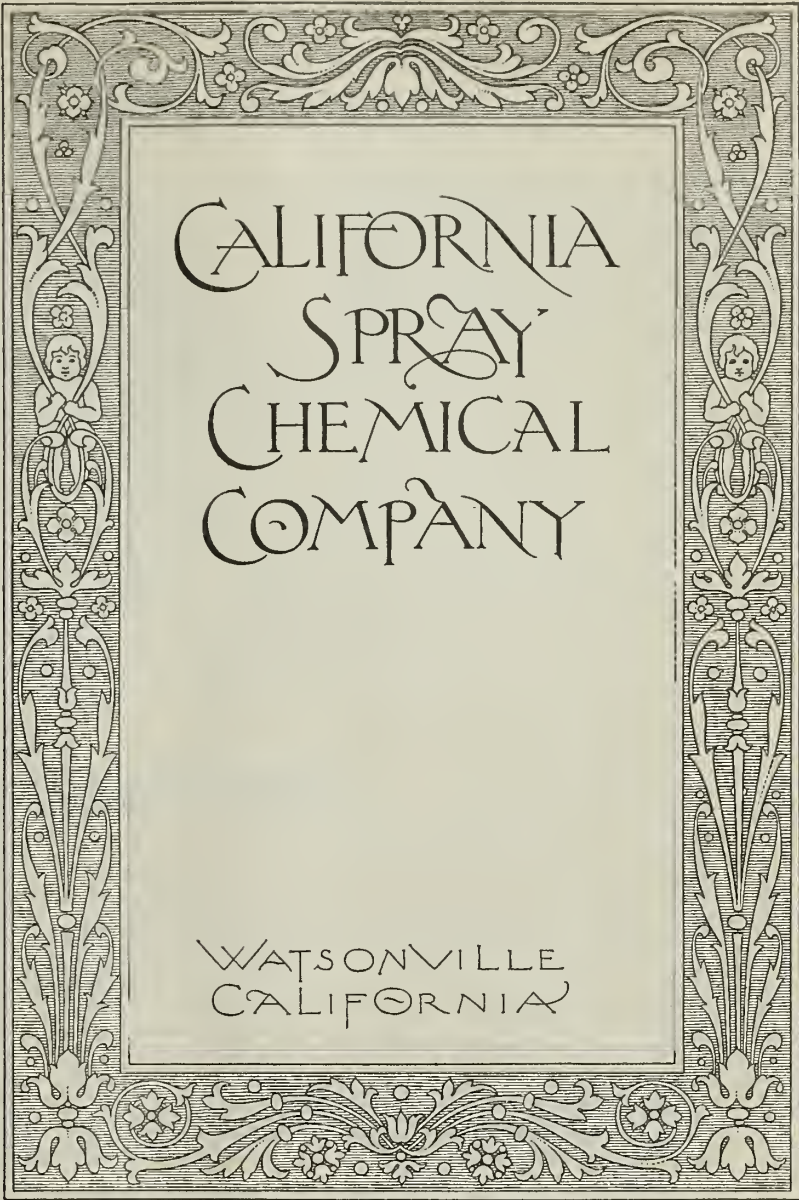
NAILS

branch was cut off the leaves would draw water from the fruit to supply the amount required for transpiration. He also found in several cases that the leaves would extract water much more readily from the immature than from the ripe fruit. His demonstrations included the cherry, plum, peach, apple, gooseberry, grape, cucumber, gourd and watermelon. In his tests the foliage withdrew moisture from the fruit until the fruit became greatly shrunken and shriveled, while the leaves maintained a normal and healthy appearance.

More recently Hodgson, in California, has demonstrated that in the citrus groves in certain sections of that state there is during hot weather a regular daily withdrawal of water from the growing fruit in the daytime, this reaching a maximum in the afternoon, followed by a restoration of the water content at night when the roots are again able to supply moisture sufficient for the needs of the trees. Hodgson is inclined to think that the excessive drop of immature fruit in some of the California citrus orchards may possibly be accounted for on the grounds that in extremely hot periods the extraction of moisture from the fruit goes so far that the tree cannot restore the water loss completely and as a consequence cuts off the fruit and casts it on the ground. This suggests that periods of summer drop in prunes and other deciduous fruits may sometimes be attributable to similar causes.

At the Geneva Experiment Station Mix has done some valuable work on the effect of drouth on apples in New York, and in the Wenatchee district of Washington Brooks and Fisher have studied the relation of abnormalities in the development of apple fruits to insufficient or irregular water supply at critical periods in the fruit growth. The peculiar external blotching known now as drouth spot and the development of corky spots or browned areas within the fruit have been definitely connected by these workers with conditions of excessive transpiration from the foliage and inadequate delivery of water by the root system or with sudden variations in the water balance within the trees. Mix has even succeeded in reproducing the drouth spot and occasionally spots resembling cork artificially by severing from the tree branches bearing both leaves and fruit, allowing the leaves to withdraw moisture from the fruit and then restoring the original state by placing the branches in water. The fruits thus treated show an appearance very similar to the corrugated appearance of the diseased prunes under discussion, which is accompanied by the death and browning of cells in the vicinity of the network of veins, as in the case also of our prunes.

There has been an unfortunate lack of extensive experimental work as yet on the effects of disturbed water relations on fruits of all kinds. We are thankful for the start made in this direction by the scientific workers mentioned above. The results of their studies are interesting and highly sug-



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gestive as far as they go, and they seem to throw some light on the problems we are discussing with regard to the prune.

At this point I wish to call attention to another condition in prune fruits which has often caused much loss and appears, as a rule, according to my ob-

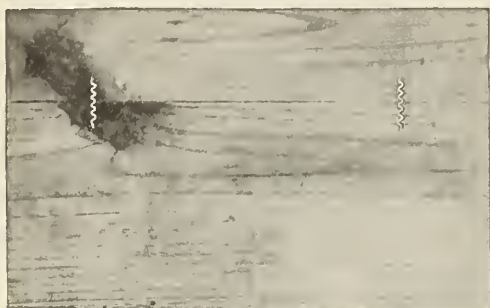
servations, later in the season than the other troubles mentioned. This is what I have sometimes called internal browning. It generally comes on about the ripening period and sometimes the grower is unaware of its existence until he examines some of the fruit preparatory to harvesting. The flesh



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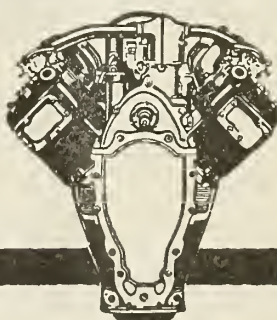
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next the pit or near the stem end is found to be dark colored as if attacked by a true rot. The discoloration may be slight or may be so extensive as to include the entire flesh, but the trouble begins in the interior of the flesh and not at the skin in most of the specimens I have seen, and for this reason cannot be confused with the true brown rot, which begins with an infection in the skin and progresses inward. The internal browning is not due to any parasite, but seems to be in some way connected with hot, dry weather late in the season. While conclusive evidence is not at hand I have a suspicion that a rainy spell following drouth may be the immediate cause, there being a possibility that the sudden supply of moisture to the fruit may rupture the tissues nearest the stem and the pit and cause the breaking down of the flesh in this way. I have had very little of this condition called to my attention this year from the Willamette Valley district, but in some years it has caused much loss only not there but also farther south.

In spite of the absence of scientific work on these non-parasitic troubles of prune fruit, I think we may feel certain that for the most part they are attributable either to excessive evaporation and insufficient moisture supply at the time the "peak" demand comes or to a sudden change from extremely dry to moist conditions of the soil and air. If this be true the only thing the grower can do is by every means within his power to promote in his orchard conservation of moisture and uniformity and steadiness of growth. The orchardist cannot control the rain and sunshine, but he can promote a better physical condition of the soil for root development and root activity not only by wise and careful cultivation but by growing deep-rooted cover crops to perforate compacted soil and to add the nitrogen and humus which so many of our soils lack, but without which maximum water-holding capacity of the soil and maximum fertility cannot be obtained. Irrigation skillfully managed is the greatest resource many prune growers have, but with all but a few—a very rare few—it is an entirely undeveloped resource. I am going to predict a rapid increase in the irrigation of prune orchards in the state in the next few years and it will be a good thing, but irrigation must be understood intelligently if its application does not bring on other troubles.

Since I could not tell you how to prevent absolutely and positively the troubles I was asked to discuss, I have tried to call your attention to the possible causes that by a better understanding of them you may be able, through a study of your own individual orchards, to put into practice methods which will help your trees to meet the critical periods more successfully than in the past. I take off my hat to the orchardist who makes the growing of prunes his business and does not leave it all to his helpless trees and nature—that is, I take off my hat to him if he knows his business.



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